DOCUMENT RESUME

ED 233 286 CG 016 865

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TITLE Relational and Item-Specific Encoding: Effects of Orienting Task, Materials, and Type of Test on Prose Memory.
PUB DATE Mar 83
NOTE 10p.; Paper presented at the Annual Meeting of the Southeastern Psychological Association (29th, Atlanta, GA, March 23-26, 1983).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cognitive Processes; College Students; Higher Education; Memorization; *Retention (Psychology); *Test Format; *Textbook Content

ABSTRACT

The type of cognitive processing most beneficial to memory may depend on the structure of the material and the type of retrieval test required. Relational encoding organizes words by their relationships, while item-specific encoding processes words on an individual basis. To obtain information on these cognitive processes as they relate to the use of textbook materials and recall, as shown by essay and multiple choice tests, 200 college students were presented with a section from a genetics textbook structured in one of four ways: keywords in italics; headings showing the organization of the material; both keywords in italics and headings; and neither italics or headings. The students were randomly assigned to process one of the different sets of material using one of six processing tasks: (1) a single relational task; (2) a tree diagram and outline, i.e., a combination of two relational tasks; (3) (4) individual item tasks, i.e., draw or define; (5) a combination of two individual item tasks, i.e., draw and define; and (6) diagram and define, a combination of relational and individual item tasks. Analyses of multiple choice test data showed significantly better performance for the define (keywords) condition. All other effects were nonsignificant. A second study examined the relationship between tree diagramming and defining, the relational and individual-item tasks, and the four materials conditions on an essay test. Data analysis indicated significantly better performance for the tree diagram condition than for the define keywords condition. (MCF)

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RELATIONAL AND ITEM-SPECIFIC ENCODING: EFFECTS OF ORIENTING TASK, MATERIALS, AND TYPE OF TEST ON PROSE MEMORY

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CG 016865

Paper presented at the Annual Meeting of the Southeastern Psychological Association, Atlanta, GA, March 23-26, 1983.

Relational and Item-Specific Encoding: Effects of Orienting Task, Materials, and Type of Test on Prose Memory

The purpose of our experiment was to extend two studies performed by Reed Hunt and Gilles Einstein in 1980 and 1981. In general, these studies investigated the hypothesis that the type of processing that is most beneficial to memory is dependent upon the structure of the material and the type of retrieval test required. The types of processing they studied were relational encoding, in which words are organized by their relationships, and item-specific encoding, in which words are processed on an individual basis. Relational processing, which Gary Ritchey has referred to as "between-item elaboration" fosters the subject's encoding of similarities among items and the integration of information into an organized structure; item-specific processing, which Ritchey called "within-item elaboration," facilitates encoding of the differences among items. The combination of orienting task and material structure that is most advantageous to memory will be that which is least superfluous; for example, organizing material which is not already obviously organized, and semantically processing individual-item information in material which is obviously organized. Further, the type of retrieval required may partly determine which type of processing is better. Recognition tests require precise knowledge of each item; therefore, item-specific processing is most helpful. Organizational strategies are better for recall tests, because of the redintegrative properties of organized information in memory.

Einstein and Hunt (1980) used a categorized word list and required subjects to rate the pleasantness of each word for their item-specific task. For the organizational task the subjects placed words in taxonomic categories. They also used some nonsemantic tasks which are not relevant to our study. Free recall and recognition tests measured memory. Distractors for the

recognition test consisted of: (1) items from the same category, (2) unrelated items with the same first letter, and (3) items from the same category with the same first letter. Performance on recognition tests was greater after individual-item processing than relational processing but performance was not affected by the processing task during free recall. The latter result may have occured because the organizational task was superfluous due to the categorized word lists used as materials.

In Experiment 2 they found an interaction between task and the type of list presented to the subject. Individual-item processing was most beneficial with categorized lists, while relational processing is best with noncategorized lists. This study also showed that a combination of relational and individual-item tasks were of greater value than either type of encoding alone. Related and unrelated lists of words were either sorted into categories, rated on pleasantness, or both sorted and rated. The design controlled for quantity of processing by having a control group repeat the item-specific or the organizational task. That is, by telling the subject to think about the word again and rerate or recategorize it independently of their previous judgement. Recognition test performance again was most aided by individual-item processing. Superior recall existed where both of the tasks were performed and repetition of tasks had no effect. An interaction also was found between the tasks and materials condition: relational processing was most beneficial with unrelated lists while individual-item processing led to the highest performance on related lists.

Our studies were performed to extend these findings to the real-world situation of textbook materials rather than word lists and to essay and multiple-choice tests rather than free recall and recognition memory tasks.

Method

Subjects. 200 students enrolled in Introductory Psychology classes at Radford University participated as subjects for extra credit. All subjects were tested in groups of 2 to 8 and each session lasted approximately one hour.

Design and Materials. All subjects were presented with a three to four page section from a genetics textbook structured in one of four ways: (1) keywords in italics, (2) headings which showed the organization of the material, (3) both keywords in italics and headings, or (4) neither italics nor headings.

Our first experiment was a 4 x 6 factorial, between subjects design with the four materials conditions just mentioned and the six processing tasks as follows: (1) a relational task in which subjects connected main ideas with line segments in a structural hierarchy; (2) tree diagram and outline, a combination of two relational tasks by making a tree diagram as described and a traditional outline without elaboration of the ideas; (3) define, an individual-item task, in which subjects used the text as a reference and wrote definitions"in their own words" for keywords of their choosing; (4) draw, an individual-item task which subjects drew illustrations to show the meanings of keywords; (5) define and draw, a combination of the two individual-item tasks of define and draw; and (6) tree diagram and define, which combines a relational and an individual-item task. Memory was tested with an unexpected essay test followed by a multiple-choice test.

Procedure. Each subject was randomly assigned to one of the 24 cells and therefore each performed a processing task with one of the different sets of material. To maintain an incidental learning situation subjects were told their hemispheric dominance would be determined by their task work.

Most apparently believed this deception, and some had to be debriefed twice before they were convinced that their laterality had not been determined. The essay test consisted of three questions that asked for a listing of major concepts from the article. The multiple choice test asked the subject to identify specific and precise aspects of key concepts. Distractors for the test were of three different types: (1) extra-story, words related to genetics which did not appear in the article, (2) intrastory keywords, and (3) intrastory nonkeywords.

Results

Seventeen subjects were eliminated from the experiment due to improper performance of the processing task, improper documentation by the experimenter or incorrect testing procedure. Various analyses of variance found no significant effects for the essay test performance, even when subjects' performances on the orienting task were scored and used as a covariant. Analyses of multiple-choice test data indicated significantly better performance for the define keywords condition than for the tree diagram condition for the multiple-choice test items with keywords as distractors. All other effects were not significant.

This one significant result was consistent with the expectation that item-specific processing would be the most effective strategy for a recognition test, especially when very precise semantic knowledge is needed to distinquish among the choices. Because of this one significant main effect and because of some problems with the sample size (due to an overly ambitious factorial design), a second study was performed to focus on these major variables. This study incorporated a 2 x 4 factorial design, with the between-subjects factors of tree diagramming and defining, the

relational and individual-item tasks, and the four materials conditions (italics, headings, both and neither). Some parts of the text article were reworded to make it more likely that subjects would generate correct tree diagrams (which was somewhat of a problem in the first experiment). 142 students enrolled in Introductory Psychology classes at Radford University participated as subjects for extra credit. The procedure was similar to the related aspects of Experiment 1. Analyses of essay data indicated significantly better performance for the tree diagram condition than for the define keywords condition. There were no significant effects for multiple-choice test performance. As expected, when subjects make accurate tree diagrams, relational processing is better than individual-item processing on essay tests. However it is not clear why nothing was significant on the multiple-choice data in the second experiment.

Discussion

Our experiments attempted to extend the findings of Einstein and Hunt from categorized word lists and laboratory-style memory tests to the more educationally relevant, real-world situation of a textbook passage, and essay and multiple choice tests. The passage was presented in ways that are used by textbook publishers to help students encode important words and organization.

After reviewing our data it was decided that one of the problems concerned the fact that not all subjects performed the orienting task work in the same manner or to the same degree of accuracy. For example, subjects performing the defining task were told not to copy the definition directly from the text but to try to put it in their own words to insure semantic processing. This statement, however, seemed to lead the individuals to

make up definitions from previous knowledge that did not relate to the genetics article and the information they activated often was either incorrect, very general or idiosyncratic. Because precise distinctions were necessary when answering the multiple-choice questions these subjects would not have processed these distinctions and would not receive the expected benefit of individual-item processing. A second example of processing inadequacy existed in the tree diagram conditions. Subjects in Experiment 1 often were confused in their attempts to organize the passage and connected the wrong ideas within the hierarchy. In Experiment 2, relational processing was more accurate and led to better essay performance than did individual-item processing.

These difficulties of poor processing performance could be alleviated by training subjects on how to make adequate tree diagrams and keyword definitions in conjunction with the text and test situation. Also, having headings or no headings is different from having categorized or uncategorized lists. In our study, there really was no "unrelated materials" condition, just conditions in which the organization was made more or less obvious by the presence or absence of headings, respectively. We felt that it is unlikely that students reading textbooks encounter disorganized or unrelated information, and that an unrelated passage condition would not be ecologically valid. Apparently, however, manipulating the degree of organization of the material by the use of headings was not a very powerful manipulation, and no main effects or interactions involving the material's factor was significant.

In summary, there is some evidence that relational processing is better than individual-item processing for free recall-type retrieval, such as

essay test retrieval. Mixed results for multiple-choice data indicate further study is needed to determine relationships among characteristics of materials, type of processing, and tests that yield the best performance.

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